RESPIRATORY HOOD

FIELD OF THE INVENTION

This invention relates to emergency safety equipment, particularly respirator hoods that provide filtered air to persons in toxic environments.

BACKGROUND OF THE INVENTION

There is increasing interest both from governmental agencies and the general public in protecting individuals from the harmful effects of toxic materials in the event of accidental incidents such as chemical spills, escape of toxic and noxious gases, smoke filled areas, dust and fumes, and in the event of chemical, biological, or other terror events.

In addition, there is a strong desire among certain people to protect their pets and work animals (seeing-eye dogs, livestock, etc.) from the same harmful effects.

Immediate protection of the respiratory tracts, eyes, and skin is required in such incidents and many of these incidents occur with little or no warning. This requires that any equipment used to protect the individual or animal (hereinafter in the specification and claims referred to as "user") be readily available, i.e. carried with the user or stored nearby, and readily deployable into an operative state.

Protective industrial masks, hoods, and powered air respirators are known, but they require skills and training in order to provide adequate protection. They are also bulky and not designed to be conveniently carried and rapidly deployed.

Often the user exposed to the toxic environment is untrained in safety procedures, such as how to don and activate a powered air respirator hood.

Most of the existing respiratory protective means are by necessity made in several sizes and do not fit both adults and children in one size.

In the event of a sudden or unexpected situation resulting in a toxic or noxious environment, it is clearly an advantage to have a device to supply filtered or purified air and also to provide nominal protection to the otherwise exposed skin of the head and neck from gases, liquids/droplets, particles, fine sprays and aerosols. Advantageously, the device should be readily available (easily carried and/or stored) and suitable for a wide size-range of users (adults, children, the elderly, the infirm, handicapped and sick people, people with beards, eyeglasses, long hair, etc., and animals) without a need to conform to facial features or body shapes. Furthermore, it is preferable that the activation and functioning is automatic, the donning is self-explanatory and comfortable, and the device is suitable for extended operation as well as short term use. It is also advantageous that the device has a long shelf life.

SUMMARY OF THE INVENTION

Accordingly, it is the objective of this invention to provide a device that protects a user from toxic environments for quick escape or for an extended period of time, typically for up to several hours, that is collapsible, easily carried or stored, compact, lightweight, comfortable, easy to use, one-size-fits-all, whose donning is self-explanatory, whose activation is automatic, and requires no training for use.

The present invention is concerned with a positive-pressure respirator hood assembly comprising, a gas-impermeable hood made of a flexible material, and comprising at least a portion which is a transparent visor; a gas treatment unit comprising a filter for filtering particles, fine spray, aerosols, and toxic and noxious gases etc. (hereinafter "hazardous materials"), and a power-operated blower to generate a positive pressure within the hood; a one-way purge valve for facilitating the exhaust of exhalation gases and moisture from the hood; and a sealing portion for sealingly securing the hood over a body portion of the user. The hood assembly is designed to allow near immediate donning to a wide range of users, requiring no training to don and operate the hood assembly, whereby a user is protected from inhalation of and facial contact with the hazardous materials.

The respirator hood is received within a container that is easily carried whereby upon opening the container and removing the respirator hood, the respirator hood is fully operational as the gas treatment unit is automatically activated. The respirator hood is foldable to allow it to fit within a small size container.

The hood, including the sealing portion, is designed such that one size provides protection from a toxic environment to users whether male or female, regardless of facial or head features such as beard, hair length/thickness, eyeglasses, etc, and regardless of size (from toddlers to large adults). The design of the hood also allows it to be used to protect animals such as pets, livestock, etc.

According to one embodiment of the invention, the sealing portion is an elastic neck seal and according to another embodiment, the sealing portion is a torso-engaging and sealing wrap.

The respirator hood may be carried and protected by a rigid container (case), in a flexible container or in a flexible container received within a case. Typically, the respirator hood is received within a sealed package for imparting it extended shelf life.

The respirator hood may be provided in some principal configurations, e.g. one for individuals from toddlers to adults, another for infants up to about the age of three years, and yet another for animals.

According to some particular designs, the operation of the blower can be stopped and the respiration hood may then be preserved for future use.

BRIEF DESCRIPTION OF THE DRAWINGS

In order to understand the invention and to see how it may be carried out in practice, a preferred embodiment will now be described, by way of non-limiting example only, with reference to the accompanying drawings, in which:

Fig. 1 is a front view of a respirator hood according to one embodiment of the invention, being worn by a user;

Fig. 2 is a side view of the respirator hood of Fig. 1;

Fig. 3 is a general exploded view illustrating the respirator hood removed from its container;

Fig. 4A shows a user carrying the respirator hood as a carry along device;

Fig. 4B shows a user carrying the respirator hood in a briefcase;

Fig. 5 is a detailed isometric exploded view of the respiratory hood assembly, also showing the gas flow path through the gas treatment unit;

Fig. 6 is a top section of the respiratory hood assembly, illustrating an activation mechanism;

Fig. 7 is a side section of the respiratory hood assembly showing the hood folded next to the gas treatment unit;

Fig. 8 is a front view of an alternate embodiment of the respirator hood used by an infant;

Fig. 9 is a rear view of the alternate embodiment of Fig. 9 illustrating a sealing and closure means;

Fig. 10 is an alternate embodiment showing the respirator hood being removed from a flexible container;

Fig. 11 is an alternate embodiment of the respirator hood showing a packaging comprising a flexible container inside an outer case;

Fig. 12 is an exploded view of an alternate embodiment with re-insertable activation mechanism;

Fig. 13 is a top section of a gas treatment unit of an alternate embodiment highlighting the re-insertable activating mechanism; and

Figs. 14A and **14B** are side views of alternate embodiments of the respirator hood used by dogs illustrating different closure means.

DETAILED DESCRIPTION OF THE INVENTION

The present invention is a respirator hood assembly that is portable, compact, easy to store, easy to carry, easy to don, easy and comfortable to use, is designed in a *one-size-fits-all* manner for users of a wide range of sizes, requires no training for use, and is activated and operates automatically.

Herein, the terms *gas* and *gases* are meant to denote the mixture of air and toxic and/or noxious gas or biological warfare agents, which may include particles, fine spray, aerosols, or droplets, collectively referred to as hazardous materials.

Referring first to Fig. 1, a respirator hood, generally designated **10**, is shown which comprises a hood **12**, made of a flexible, gas and liquid-impermeable material and a gas treatment unit **14** attached to the hood **12**. The hood **12** includes a visor **16**, also made of a flexible, gas-impermeable material, positioned adjacent to the eyes of a user **18**.

Still referring to Fig. 1, fastened to the hood **12** is a sealing portion in the form of a collar or neck seal **20** made of an elastic material such as silicone, polyurethane, latex rubber, etc., allowing easy donning and requiring no latches, straps, ties, or the like. The neck seal **20** is sized to be, in the non-stretched condition, slightly smaller than that of a small toddler and whose material is such that it is easily stretched to a size conveniently larger than the head of a large adult user **18** regardless of long or thick hair, beards, etc. Further, the neck seal **20** is dimensioned to be wide enough for wearing comfort. With this design, the respirator hood **10** is easily and conveniently donned within seconds by a wide range of individuals without need for training or operating instructions.

Fig. 1 further shows a cape or shroud **22** extending downward in a skirt-like manner fitting around the neck toward the shoulders of the user **18** to protect the neck. A one-way purge valve **24** is integrated into the hood **12** to facilitate the exhaust of perspiration and exhalation gases such as carbon dioxide and moisture from the hood **12** while not allowing the entrance therethrough of outside gases. The one-way purge valve may be any suitable valve, outlet, or flow device, permitting the flow of gases, vapors or moisture in one direction only.

In Fig. 2 arrow **26** shows where ambient gases enter the gas treatment unit **14**, arrow **28** shows where filtered air then enters the hood **12**, and arrow **30** shows where exhalation (exhaled air) and moisture exit from the hood **12** via the purge valve **24**. Seen again are side views of the visor **16** the neck seal **20**, and the shroud **22**.

Fig. 3 shows a respirator hood assembly **11** comprising the respirator hood **10** and its container, which is in the form of a rigid case, generally designated **32**, after the container **32** has been opened and the respirator hood **10** has emerged. At this point the respirator hood **10** is completely ready for donning and use. Container **32** comprises a front cover **34** and a rear cover **36**.

The covers **34** and **36** are not part of the respirator hood **10** that is worn by the user **22**, however they are important in that they form the container **32** which forms a protective casing around the respirator hood **10** in order ensure/prolong the shelf life. Optionally, a gas-impermeable seal is formed which prevents the ingress of humidity since filters of the type used in respiratory protective devices are sensitive to humidity. The container **32** can be carried using either of its front handle **38** and a rear handle **40**, which are part of the container **32**. The handles **38** and **40** are also used to open the container **32**, which automatically activates the gas treatment unit **14**, as described below. Additionally, the container **32** plays a significant role in activation of the gas treatment unit **14**, as will become apparent hereinafter.

Figs. 4A and 4B illustrate how the lightweight and compact respirator hood assembly **11** is easily carried by the user **18** as a carry along (Fig. 4A) or may fit within a briefcase **44** (Fig. 4B). If carried as a carry along, as shown in Fig. 4A, the assembly **11** can include rings (not shown), or the like, for attaching an auxiliary carrying strap **42**. Desirably, the respirator hood assembly **11** fits into a portion of a typical small briefcase **44**. Analogously, the respirator hood assembly **11** can be carried in a purse or backpack (not shown).

The convenient carrying and compact storage features of the respirator hood assembly **11** are important in that they provide immediate availability of the respirator hood **10** to the user **18**. These features, along with the automatic activation of the gas treatment unit **14** (discussed below) and simple donning, allow the respirator hood **10** to be in full use within seconds. Rapid deployment can be critical to the health, or even survival, of the user **18**.

In Fig. 5 an arrow **46** indicates the gas flow path. Gases enter the gas treatment unit **14** firstly through an opening **48** in a housing **50** that accommodates the gas treatment unit **14**. The opening **48** is exposed to the ambient as soon as the front cover **34** is detached or removed. A washer **52** provides a seal between the housing **50** and a filter **54** that filters the incoming gases. The filter **54** is any suitable filter as known in the art for filtering of hazardous materials such as particles, toxic/noxious gases, fine sprays and aerosols. The filter **54** is sealed to a base **56** by a washer **55**. The base **56** is fitted on a manifold **58**. The manifold **58** distributes the gases, now filtered, back through an opening **60** of the base **56**. The filtered gases then enter and exit a battery powered blower **62** through a fitting **64** and an opening **66**. The blower **62** is sealed to the housing **50** by washer **67**. Through the opening **66**, the filtered gases enter the hood **12**. The hood **12** is fastened to the gas treatment unit **14** between the fitting **64** and a fitting **65**. The washers **52, 55** and **67** are all replaceable by a suitable glue or other sealing compound such as silicone or epoxy.

Also seen in Fig. 5 is a battery **68** that powers the blower **62**. The power is activated automatically when the covers **34** and **36** of the container **32** are opened, typically by handles **38** and **40**. An activating mechanism utilizing a latch **70**, a toggle **72**, and a switch **74** is explained below. The latch **70** sits in an indentation **76** (see also Fig. 6). Fitting into the housing **50** is a blower cover **78**, which can be made in different configurations to add flexibility to the design of the components in the gas treatment unit **14**.

Blower **62** produces a positive pressure within the hood **12** which improves the protection to the user **18** by preventing entry of gases via the neck seal **20** in the event the neck seal **20** is loose or if openings occur due to movement of the user **18**. The positive pressure produced by the blower **62** also prevents the entry of gases into the hood **12** as it is donned, prevents build-up of exhalation gases such as carbon dioxide and moisture (including the exhaust of perspiration, which improves the comfort of the user **18**).

Fig. 6 is a top section of the respirator hood assembly **11** showing the parts that activate the blower **62**. The latch **70** the top of which fits in the indentation **76**, is actuated when the front cover **34** is opened. Separating the cover **34** from the respirator hood **10** causes the latch **70** to rupture and thus in this embodiment the operation of the respirator hood **10** is irreversible once the respirator hood **10** is operated. As the front cover **34** is detached or removed, latch **70** is pulled outwardly and thereby pulls on toggle **72** which activates the switch **74**, thereby facilitating power to the blower **62**, which is powered by the battery **68**.

Fig. 7 shows a side section of the respirator hood assembly **11**, showing the hood **12** folded between the covers **34** and **36**. The compactness of the collapsible hood **12** is illustrated, as well as the fastening of the hood **12** to the gas treatment unit **14** by the fittings **64** and **65**.

To use the respirator hood **10**, the covers **34** and **36**, of container **32**, are separated/detached and removed. The covers **34** and **36** are no longer needed. As described above, this activates the blower **62** making the gas treatment unit **14** and respirator hood **10** fully operational. The neck seal **20** is then stretched over the head of the user **18**. There are no other actions necessary. Even if the respirator hood **10** is donned backward or to the side, i.e. with the visor **16** not in front of the eyes, the user **18** is still protected. Furthermore, the hood **12**, or a large enough portion of it, may be made of a transparent or translucent material affording the user **18** reasonable visibility. Alternatively, the hood **12** can be easily adjusted to a more appropriate. The positive pressure within the hood **12**, produced by the blower **62**, prevents ingress of the unwanted gases during any adjustment of the hood **12**. Thus, the respirator hood **10** is easily operated and used without the need for operating instructions even in time of stress.

It is appreciated that an untrained person of an age of from about three years to a complete, and large sized, adult can have ready access to, and can use a device according to the invention for head and neck protection and for the supply of

pressurized purified air in the event of sudden exposure to toxic or noxious gases including particles, fine spray or aerosols.

Fig. 8 illustrates an alternate embodiment where an infant **90** uses the invention. It is dangerous to fit a neck seal around the neck of an infant **90** and so here a hood **92** which includes a visor **94** is designed to fit over the head and upper body of the infant **90**. The arms of the infant **90** may be completely inside the hood **92** (this option not shown) or may sealingly protrude from the sides **96** and **97** which are formed when the hood **92** is closed around the torso of the infant **90**.

Fig. 9 illustrates one option of how the alternate embodiment shown in Fig 9 may be closed around the torso of the infant **90**. Any suitable closure means can be used, such as an elastic seal (analogous to neck seal **22**) suitable for an infant's torso, however, typically a hook and loop type fastener, commonly known as VELCRO™, is the most convenient. A portion containing hooks **98** and a portion containing loops **99** is shown. The hooks **98** and loops **99** portions can be reversed. This arrangement is also suitable for people suffering from neck injuries, etc.

Fig. 10 shows a different embodiment in which the respirator is contained in a flexible container such as a foil or laminated bag **110**. The bag **110** is made of a gas-impermeable material to protect the respirator hood **10** (especially the filter **62** from humidity, to ensure long shelf life) and is preferably made of a material that provides mechanical protection as well. Automatic activation in this embodiment can be achieved by various means including, for example, by activating a switch such as the switch **74** (Fig. 6) (or a switch **136** shown in Figs. 12 and 13) which can be articulated with an opening edge **114** of the bag **110**, or a tear-ribbon, etc. The bag **110** preferably includes a handle **116** for easy carrying.

It should be understood that several variations on this embodiment are possible, including, but not limited to, one where the respirator hood **10** is activated by stretching the neck seal **22** before donning.

Fig. 11 illustrates a packaging arrangement in which the respirator hood **10** is contained in a flexible container such as a foil, laminated or plastic bag **118**

which is further contained within an outer rigid container, generally designated **120**, which provides mechanical protection for the respirator hood **10**. The outer container **120** could be a rigid case, a tough sack or other suitable container. In this embodiment the bag **118** need not provide mechanical protection, but is still preferably made of a gas-impermeable material. The top cover **122** and bottom cover **124** may be held together by any suitable means such as mechanically, by pressure sensitive adhesive, etc.

Fig. 12 shows an exploded view of an alternate respirator hood assembly, generally designated **126**, emphasizing the internal components of an alternate gas treatment unit, generally designated **128**. In this embodiment the activation of a respirator hood, generally designated **130**, is reversible, i.e. it is possible to stop the operation of the gas treatment unit **128** and preserve it for future use. This is useful if, for example, the respirator hood **130** was accidentally activated or the user **18** escapes from, but needs to return to a toxic environment, etc.

An activation pin **132**, typically integral to a bottom cover **134**, penetrates into the gas treatment unit **128** compressing a switch **136** when the assembly **126** is in the packaged condition (best seen in Fig. **13**). Detaching or removal of the respirator hood **130**, from the bottom cover **134** detaches the pin **132** from the switch **136** thereby actuating the switch **136**. The pin **132** can be re-inserted to re-compress the switch **136** and shut down the blower **54** of the gas treatment unit **128** to de-activate the respirator hood **130**.

Also shown in Fig. 12 is a lip **146** on the cover **138** to aid in opening the covers **134** and **138**. A covering **148**, which is preferably a gas-impermeable material, in order to protect the gas treatment unit **128** from humidity/moisture, etc., is adjacent to the cover **138** and attached to cover **134** at its perimeter. A tab **150** is provided for easy peel back of the covering **148**. A handle **152** is integral to the cover **134**, which along with the lip **146** makes for easy gripping of the assembly **126**. The handle **152** and the lip **146** are also used for easy opening of the covers **134** and **138**.

Fig. 13 shows a top section of the gas treatment unit **128** highlighting the re-insertable pin **132** which is part of the activation mechanism. Since the pin **132** is integral to the cover **134**, detaching or removal of the cover **134** detaches the pin **132** from the switch **136.** The blower **62** is thus actuated and the gas treatment unit **128** and the respirator hood **130** are then fully operational.

Figs. 14A and 14B show embodiments that are suitable for animals; depicted by a small dog **160** (Fig. 14A) and a large dog **162** (Fig. 14B). For the small dog **160** a hook and loop closure means, discussed above for infants, may be appropriate. For a large dog **162,** a sealing portion such as the elastic neck seal **20** for a human adult user **18** may be appropriate. For animals, hoods **164** and **166,** including visors **168** and **170,** may require some size and shape differentiation from humans and size and shape differentiation from animal to animal depending on type and size. In the case of very small animals, for example gerbils (not shown), the animal, or more than one animal, can be completely inside the hood **164; 166.**